Achievements and Ambitions: an Overview of the Current European Project Landscape

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EXDCI2
Introduction

• EU is committed to develop the next generation of HPC systems and applications
  • “systems 50x to 100x faster than 2017 on real apps” in 2023

• In a context of HPC frontier extensions
  • Discovery process
    • Data oriented approach
    • Digital twins
  • Spatial
    • The Exascale
    • The Edge, the Fog
  • Technological
    • Software: new hourglass model, workflows, containers
    • Hardware (e.g. NVM, photonics, Percipient storage, …)
FET-HPC Projects Growth (Projects and Members)

2014 - #136 nodes
2015 - #195 nodes
2016 - #209 nodes
2017 - #210 part. #47 projects
2014 European FET-HPC Projects & Results
HPC System Oriented Projects

- From silicon package to system
  - Interposer, UNIMEN architecture, interconnect, software stack

- ARM-based HPC
  - Demonstrator and software stack

- Reconfigurable compute
  - Architecture, programming environment
  - Time constraint architecture

- IO
  - New memory hierarchy
  - File system
HPC Stack and Application Oriented Projects

- Energy efficiency
  - Metric, DSL, autotuning
- Programming models
  - OmpSs, StarPU, GASPI, PaRSEC, MPI, OpenMP
  - C++ templates + tool chain
- Deployment of multiscale applications
- Generic applications
  - Hyperbolic PDE
  - Fluid dynamics
  - Machine learning (for drug discovery)
  - Numerical linear algebra
  - Weather models
### Results of the Projects (1)

Iceotope have filed 10 patents within the FETHPC project, 8 in ExaNeSt and 2 in EuroEXA.

#### Type of result

<table>
<thead>
<tr>
<th>Type of result</th>
<th>Number per type of result</th>
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<td><strong>Total</strong></td>
<td><strong>138</strong></td>
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## Results of the Projects (2)

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<td><strong>Total</strong></td>
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### Software

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Demonstrators Developed by the Projects (1)

- **Exanode-ExaNeST-EcoScale**
  - Based on ExaNest daughter board
  - ~20 boards

- **MANGO**
  - 8 HPC servers and 196 FPGA

- **DEEP**
  - Modular Supercomputing concept developed in the DEEP projects is now also used in production machines at JSC

- **Greenflash**
  - To demonstrate control of telescope mirrors
Demonstrators Developed by the Projects (2)

- **SAGE**
  - Open to test; 4 tiers of storage

- **NextGenI O**
  - based on DC Persistent Memory™, next-generation non-volatile memory technology

- **Mont-Blanc**
  - Open to test; Dibona 96 sockets
  - ARM ThunderX2

**First commercial system acquired by CEA**
Conclusion

- The European organization landscape is evolving profoundly
  - EuroHPC joint undertaking
  - European Open Science Cloud
  - European Processor Initiative

- To address many challenges
  - More technology developments in Europe
  - Creating synergies between HPC/HPDA/IoT
  - Exascale applications able to address our societal challenges
<table>
<thead>
<tr>
<th>Techno Targeted user</th>
<th>Computing node/board</th>
<th>Interconnect/Memory hierarchy</th>
<th>Storage/file system</th>
<th>Tools for FPGA</th>
<th>Software stack</th>
<th>Programming model/tool</th>
<th>Optimization tools</th>
<th>Library</th>
<th>Application</th>
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Frontier Extension, an Example the Digital Twins

Src: Jens Krueger ITWM Faunhofer, BDVA/ETP4HPC/EXDCI2